

## SALT RIVER BASIN

The Salt River basin is the most centrally located basin in Kentucky. The main stem of the Salt River originates in central Boyle County, Kentucky, and flows northward for 30 miles to the vicinity of Lawrenceburg. From there, the river flows in a westerly direction about 95 miles to its confluence with the Ohio River at West Point, Kentucky (Ohio River mile point 351). Principal tributaries are Rolling Fork, Floyds Fork, Beech Fork, and Brashears Creek. There are 1,552 miles of streams in the basin depicted on the USGS hydrologic unit map. Total drainage area is 2,929 square miles.

The Salt River basin lies primarily within the Blue Grass section of the Interior Low Plateaus Province, with a small portion occurring in the Highland Rim section. The stream drains mainly Ordovician age limestone. Basin topography varies from irregular, steep-sided hills with V-shaped valleys to gently rolling hills with broad floodplains.

Average slope of the main stem of Salt River is 5.0 feet/mile, while Rolling Fork averages 6.0 feet/mile, Beech Fork averages 4.0 feet/mile, Brashears Creek averages 6.0 feet/mile, and Floyds Fork averages 7.0 feet/mile.

### Impacts

Major impacts upon the Salt River are agricultural runoff, including fertilizer and pesticides, and domestic sewage. This has led to high nutrient loads in some areas. If planned oil shale operations in the Knobs area become reality, segments of the Salt River drainage could be impacted.

Many portions of the Salt River drainage support a diverse assemblage of aquatic organisms. Four fish kills were reported in 1982 and four in 1983.

### Problem Parameters

Problem parameters include suspended solids, total phosphorus, fecal coliform bacteria, copper and zinc. Arsenic and chlordane were elevated in sediments.

### Flow

The annual average discharge for the period of record (45 years) is 1572 cfs for the Salt River at mile point 22.9. Mean discharge for water year 1982 was below the annual average discharge (-29%). During water year 1983, mean discharge was 3% below annual average. The concentration effect of flow reduction during the reporting period was a contributing factor to observe increases in certain physicochemical parameters.

### Biological

The 1983 biological collections from the Salt River station showed an appreciable increase in macroinvertebrate species diversity, periphyton, chlorophyll a and algal abundance.

In the years since 1979, the biological collections have reflected with considerable accuracy the physical characteristics of that stream, notably, turbidity from siltation and nutrient enrichment. The newly constructed Taylorsville Lake, upstream of the sampling site, and low flow conditions most likely have reduced those values enough to explain the increases in the 1983 collections. Water quality in this stream from the Taylorsville Dam downstream to the Ohio River is considered to be fair.

### Hydrologic Unit 05140102 - Salt River/Floyds Fork

A total of 776 miles of streams draining 1471 square miles comprise this hydrologic unit. Major urban centers include Shelbyville (pop. 5,329), Shepherdsville (pop. 4,454), Fort Knox Military Reservation, Radcliff (pop. 14,519), Okolona, as well as urban areas of southern and eastern Jefferson County. Recreation centers include Taylorsville Lake, Guist Creek Lake, and McNeely Lake. Four water quality monitoring stations are located in this hydrologic unit: Salt River at Shepherdsville, Pond Creek at Manslick Road, Floyds Fork near Crestwood, Floyds Fork at Fisherville.

The Floyds Fork drainage, encompassing approximately 192 stream miles, has been recommended for designation as Aquatic Life/Warmwater Aquatic Habitat use. All of the stream miles have also been recommended for Primary and Secondary Contact Recreation use. The major impact to the Floyds Fork drainage is wastewater treatment plant effluent. Violations for Kentucky Surface Water Standards were observed for mercury, aluminum, phthalate esters, cadmium, dissolved oxygen, undissociated hydrogen sulfide, iron, pH and fecal coliform bacteria. Therefore, the Floyds Fork drainage is considered to partially support the recommended uses.

An additional 24 stream miles (Mill Creek drainage) on the Fort Knox Military Reservation has been recommended to be designated for Aquatic Life/Warmwater Aquatic Habitat and Primary and Secondary Contact Recreation uses. The major impacts to this stream are municipal waste from the city of Radcliff, Kentucky and Fort Knox and siltation arising from military activities in the watershed. Violations of Kentucky Surface Water Standards for cyanide, undissociated hydrogen sulfide, phthalate esters, unionized ammonia, and aluminum were observed during a stream use designation study. The Mill Creek system supports the recommended uses in the upper 12 miles but the remaining 12 miles only partially support the recommended uses.

#### o Dissolved Oxygen (DO) (mg/l)

For the reporting period DO ranged from a minimum of 3.2 to a maximum of 13.4 with a mean range of 8.2 to 9.9 and a median range of 8.9 to 9.0.

#### o pH

For the reporting period pH ranged from a minimum of 7.0 to a maximum of 8.3 with a mean range of 7.5 to 7.9 and a median range of 7.5 to 7.9. For the period of record (1979-1983) pH ranged from a minimum of 6.6 to a maximum of 9.0 with a mean range of 7.5 to 7.9 and a median range of 7.5 to 7.9.

#### o Acidity (mg/l)

For the reporting period acidity ranged from a minimum of 0.0 to a maximum of 49.0 with a mean range of 12.4 to 14.0 and a median range of 8.8 to 11.8. For the period of record (1979-1983) acidity ranged from a minimum of 0.0 to a maximum of 49.0 with a mean range of 8.7 to 10.4 and a median range of 7.6 to 9.2.

#### o Alkalinity (mg/l)

For the reporting period alkalinity ranged from a minimum of 56.0 to a maximum of 213.0 with a mean range of 134.1 to 155.0 and a median range of 132.0 to 148.0. For the period of record (1979-1983) alkalinity ranged from a minimum of 8.4 to a maximum of 336.0 with a mean range of 130.1 to 200.0 and a median range of 132.0 to 220.0.

o Conductivity ( $\mu$ mhos/cm)

For the reporting period conductivity ranged from a minimum of 170.0 to a maximum of 713.0 with a mean range of 394.5 to 589.6 and a median range of 371.0 to 593.0. For the period of record (1979-1983) conductivity ranged from a minimum of 170.0 to a maximum of 723.0 with a mean range of 413.8 to 565.2 and a median range of 430.0 to 575.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 4.0 to a maximum of 77.0 with a mean range of 7.8 to 42.5 and a median range of 8.1 to 43.7. For the period of record (1979-1983) chlorides ranged from a minimum of 4.0 to a maximum of 77.0 with a mean range of 8.2 to 39.6 and a median range of 8.0 to 38.6.

o Sulfates (mg/l)

For the reporting period sulfates ranged from a minimum of 16.3 to a maximum of 113.0 with a mean range of 42.5 to 88.9 and a median range of 43.0 to 92.0. For the period of record (1979-1983) sulfates ranged from a minimum of 3.5 to a maximum of 156.6 with a mean range of 39.5 to 87.0 and a median range of 38.2 to 87.5.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.04 to a maximum of 6.5 with a mean range of 1.9 to 2.6 and a median range of 2.28 to 2.43. For the period of record (1979-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.04 to a maximum of 6.5 with a mean range of 0.94 to 2.45 and a median range of 0.79 to 2.2.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.022 to a maximum of 3.25 with a mean range of 0.103 to 1.58 and a median range of 0.06 to 1.48. For the period of record (1979-1983) total phosphorus ranged from a minimum of 0.02 to a maximum of 3.25 with a mean range of 0.146 to 1.47 and a median range of 0.10 to 1.48.

o Fecal Coliform

Fecal coliform standards were exceeded 59% of the time during the reporting period. The highest percentage of violations occurred at the Pond Creek at Manslick Road station.

Biological

The Salt River at Shepherdsville station was characterized by dense growths of filamentous green and blue-green algae as well as euglenoid algae and centric diatoms. A visible plankton bloom (chlorophyll *a* = 35.7  $\mu$ g/l) was noted during July, 1983, consisting of *Anacystis cyanea*, a blue-green algae, and centric diatoms. Periphyton chlorophyll *a* values were above average (39.2 mg/m<sup>2</sup>, Range (20.1-72.8) while AFDW values were near average (3.97 g/m<sup>2</sup>, Range (2.00-6.47). A total of 181 algal species were identified from natural substrates. The abundance of planktonic species partially accounted for the above average number of taxa observed here. The diatom community was dominated by centric diatoms and eutrophic pennate diatom species. While the community was more speciose than usual in 1983, the community structure was similar to that observed since 1979. Algal abundance (biomass and standing crop) was greater

in 1983 than in previous years due to lower flow in addition to the presence of Taylorsville Lake (located 35 miles upstream). The Taylorsville Dam may be allowing suspended sediment to settle out of the water column, resulting in less turbidity at this site. Increased light penetration here may explain the enhanced algal productivity.

The invertebrate collections from this station reflect with considerable accuracy the physical characteristics of the stream. The organisms collected here are routinely associated with sluggish streams that maintain elevated nutrients and heavy silt loading during most of the year. The 1983 invertebrate collections were more diverse in species composition and community structure than previous years. Water quality is considered to be fair at this location.

No F.D.A. action levels were exceeded in fish tissue at this station in 1982 or 1983.

#### Hydrologic Unit 05140103 - Rolling Fork/Beech Fork/Chaplin River

A total of 776 miles of streams draining 1449 square miles comprise this hydrologic unit. Major urban centers include Bardstown (pop. 6,155), Springfield (pop. 3,179), and Lebanon (pop. 6,590). Recreation centers include Beaver Creek Lake and Willisburg Lake. Two water quality monitoring stations are located in this hydrologic unit: Beech Fork at Maud and Rolling Fork near Lebanon Junction.

##### o pH

For the reporting period pH ranged from a minimum of 7.4 to a maximum of 8.1 with a mean range of 7.7 to 7.8 and a median range of 7.8 to 7.9. For the period of record (1980-1983) pH ranged from a minimum of 7.3 to a maximum of 8.1 with a mean range of 7.7 to 7.8 and a median range of 7.8 to 7.8.

##### o Alkalinity (mg/l)

For the reporting period alkalinity was not measured. For the period of record (1973-1983) alkalinity ranged from a minimum of 48.0 to a maximum of 200.0 with a mean range of 128.6 to 141.1 and a median range of 120.0 to 150.0.

##### o Conductivity (µmhos/cm)

For the reporting period conductivity ranged from a minimum of 185.0 to a maximum of 531.0 with a mean range of 333.7 to 398.4 and a median range of 280.0 to 390.0. For the period of record (1973-1983) conductivity ranged from a minimum of 58.0 to a maximum of 540.0 with a mean range of 347.0 to 357.0 and a median range of 335.0 to 350.0.

##### o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 2.1 to a maximum of 15.0 with a mean range of 4.7 to 7.8 and a median range of 4.5 to 5.0. For the period of record (1973-1983) chlorides ranged from a minimum of 0.6 to a maximum of 19.0 with a mean range of 4.9 to 6.0 and a median range of 4.7 to 5.4.

##### o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N was not measured. For the period of record (1974-1981) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.09 to a maximum of 1.5 with a mean of 0.64 and a median of 0.62.

o        Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.08 to a maximum of 0.72 with a mean range of 0.144 to 0.358 and a median range of 0.13 to 0.29. For the period of record (1973-1983) total phosphorus ranged from a minimum of 0.04 to a maximum of 0.87 with a mean range of 0.19 to 0.24 and a median range of 0.15 to 0.19.

## GREEN RIVER BASIN

The Green River basin has the largest surface drainage area of the river basins in the Commonwealth of Kentucky. Flowing approximately 330 miles in a northwesterly direction from its headwaters to its confluence with the Ohio River (mile point 636.4) above Henderson, Kentucky, the river drains an area of 8,821 square miles of west-central Kentucky and 408 square miles in north-central Tennessee. Principal tributaries include the Nolin, Barren, Mud, Rough and Pond rivers. There are 3,602 miles of stream in the basin depicted on the USGS hydrologic unit map. Major impoundments of this basin include Nolin, Barren, Rough and Green River reservoirs.

The Green River basin lies in the Interior Low Plateaus Province. The major section within this physiographic region is the Highland Rim or Pennyroyal. This area is generally a plateau of low relief, crossed by deeply entrenched streams and includes high, somewhat isolated, hills or outliers of rocks of adjoining sections or provinces. Karst topography and cavern networks are a common characteristic of the section, although normal surface drainage is predominant for most of the area. The Highland Rim is underlain by Mississippian limestone. The remainder of the basin lies in the Shawnee Hills or western Kentucky coalfield and is underlain by strata of Pennsylvanian age. This section can be generally characterized as an area with hills and ridges on an upland terrain with expansive, nearly flat floodplains occurring along the lower Green River and its main tributaries.

The main stem of the Green River flows into the Ohio River at 338 feet above mean sea level (m.s.l.) and is controlled by a series of six locks and dams for navigational purposes. Upstream of these structures the river arises at an average slope of 1.6 feet/mile, with tributaries having averages ranging from 0.8 feet/mile to 7.7 feet/mile and having a maximum elevation of 1,040 feet above m.s.l.

### Impacts

Since a large portion of the Green River lies in the western Kentucky coalfield, silt and acid from coal mining operations are the major impacts. These impacts can be locally heavy, rendering some streams severely degraded. Agricultural runoff, including livestock feeding operations, contribute nutrient loading to some streams. Brine from oil drilling has caused increased chloride levels in portions of the river for many years.

The aquatic biota of the coalfields has been degraded by siltation and acid mine drainage. Brines have also impacted the aquatic biota of the oil and gas regions of the basin. However, many subbasins of the drainage support a diverse assemblage of aquatic organisms. Two fish kills were reported in 1982 and five in 1983. There are 10 ambient monitoring stations in the basin.

### Problem Parameters

Nitrite and nitrate-nitrogen and copper were elevated throughout the basin. Sediments showed high levels of chlordane.

### Flow

The annual average discharge for the period of record (53 years) is 11,220 cfs for the Green River at mile point 63.4. Mean discharge for water year 1982 was slightly above (+2%) the annual average discharge. During water year 1983, mean discharge was 26% above annual average.

### Hydrologic Unit 05110001 - Upper Green River and Nolin River

A total of 1,331 miles of streams draining 3,140 square miles comprise this hydrologic unit. Major urban centers include Campbellsville (pop. 8,715), and Columbia (pop. 3,710). Recreation centers include Green River Lake, Nolin Lake and Mammoth Cave National Park. Four water quality monitoring stations are located in this hydrologic unit: two on Green River, one on Nolin River and one on Bacon Creek.

o Dissolved Oxygen (DO) (mg/l)

For the reporting period DO ranged from a minimum of 6.4 to a maximum of 14.0 with a mean range of 9.3 to 9.8 and a median range of 9.4 to 9.8.

o pH

For the reporting period pH ranged from a minimum of 6.8 to a maximum of 8.2 with a mean range of 7.5 to 7.7 and a median range of 7.5 to 7.7. For the period of record (1979-1983) pH ranged from a minimum of 6.7 to a maximum of 9.2 with a mean range of 7.5 to 7.7 and a median range of 7.5 to 7.8.

o Acidity (mg/l)

For the reporting period acidity ranged from a minimum of 1.7 to a maximum of 58.2 with a mean range of 5.8 to 13.7 and a median range of 4.4 to 10.0. For the period of record (1979-1983) acidity ranged from a minimum of 0.0 to a maximum of 58.2 with a mean range of 7.0 to 11.0 and a median range of 4.2 to 9.4.

o Alkalinity (mg/l)

For the reporting period alkalinity ranged from a minimum of 26.2 to a maximum of 188.0 with a mean range of 54.6 to 167.4 and a median range of 50.8 to 169.0. For the period of record (1979-1983) alkalinity ranged from a minimum of 25.2 to a maximum of 207.6 with a mean range of 58.9 to 162.7 and a median range of 54.5 to 169.0.

o Conductivity ( $\mu$ mhos/cm)

For the reporting period conductivity ranged from a minimum of 109 to a maximum of 609 with a mean range of 162.2 to 345.2 and a median range of 138.0 to 353.0. For the period of record (1979-1983) conductivity ranged from a minimum of 6.6 to a maximum of 750.0 with a mean range of 156.5 to 341.9 and a median range of 142.0 to 338.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 2.4 to a maximum of 57.4 with a mean range of 4.0 to 21.5 and a median range of 3.7 to 17.6. For the period of record (1979-1983) chlorides ranged from a minimum of 0.9 to a maximum of 57.4 with a mean range of 3.9 to 19.1 and a median range of 3.7 to 15.9.

o Sulfates (mg/l)

For the reporting period sulfates ranged from a minimum of 2.0 to a maximum of 60.3 with a mean range of 4.8 to 12.0 and a median range of 4.5 to 12.6. For the period of record (1979-1983) sulfates ranged from a minimum of 2.0 to a maximum of 70.5 with a mean range of 7.7 to 14.9 and a median range of 6.0 to 13.1.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.055 to a maximum of 14.7 with a mean range of 0.628 to 3.05 and a median range of 0.56 to 2.68. For the period of record (1979-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.05 to a maximum of 14.7 with a mean range of 0.63 to 2.6 and a median range of 0.55 to 2.4.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.004 to a maximum of 1.33 with a mean range of 0.031 to 0.12 and a median range of 0.024 to 0.11. For the period of record (1979-1983) total phosphorus ranged from a minimum of 0.004 to a maximum of 1.33 with a mean range of 0.03 to 0.12 and a median range of 0.025 to 0.12.

o Fecal Coliform

Fecal coliform standards were exceeded 21% of the time during the reporting period. The highest percentage of violations occurred at the Bacon Creek station.

o Biological

The Green River at Munfordville station was characterized by moderate growths of filamentous green, blue-green, and red algae, as well as pennate diatoms. Periphyton chlorophyll *a* values were above average (26.0 mg/m<sup>2</sup>, Range (18.0-31.4)) as were AFDW values (5.81 g/m<sup>2</sup>, Range 3.88-9.71). Plankton chlorophyll *a* values were below average (6.5 ug/l) but are typical for streams. Benthic algal growths here are most likely enhanced by nutrient enrichment from agricultural activities as well as the relative lack of turbidity. A total of 141 algal species were identified from natural substrate collections. The diatom community was dominated by typical stream species as well as those characteristic of nutrient enrichment. The Green River appears to be a productive stream of good water quality.

The 1982-83 invertebrate collections from the Green River at Munfordville represented extremes in stream flow regimes. The 1982 collections were largely influenced by high water conditions. The 1983 collections represented an extended drought period. The invertebrate community structures and species composition reflected those extreme conditions with considerable accuracy in relation to the habitats and functional capacities of the affected organisms. Since the 1983 collections represented a threefold increase in the number of species (9 to 30), it is assumed that high water conditions during 1982 influenced those collections. The 1983 collections reflected considerable habitat partitioning and species diversity within most of the functional groups. Based on those observations, the water quality appears to be adequate and does not limit the benthic community.

No F.D.A. action levels were exceeded in fish tissue at this station in 1982 or 1983.



### Hydrologic Unit 05110002 - Barren River

A total of 630 miles of streams draining 2264 square miles comprise this hydrologic unit. Major urban centers include Bowling Green (pop. 40,450) and Glasgow (pop. 12,958). Recreation center includes Barren River Reservoir. One water quality monitoring station is located in this hydrologic unit: Barren River at Bowling Green.

A total of 58 stream miles of the upper Gasper River (26 miles) and its tributaries (32 miles) has been recommended for Aquatic Life/Warmwater Aquatic Habitat and Primary and Secondary Contact Recreation use designations. A stream use designation study conducted in the upper Gasper River system revealed violations of Kentucky Surface Water Standards for aluminum, mercury and iron. This stream system supports an excellent diversity of aquatic habitats and a speciose aquatic community. With the exception of 10 miles of Black Lick Creek which partially supports recommended use designation, this area supports the recommended use.

o Dissolved Oxygen (DO) (mg/l)

For the reporting period DO ranged from a minimum of 6.4 to a maximum of 13.0 with a mean of 8.9 and a median of 8.9.

o pH

For the reporting period pH ranged from a minimum of 7.0 to a maximum of 8.0 with a mean of 7.8 and a median of 7.8. For the period of record (1979-1983) pH ranged from a minimum of 6.8 to a maximum of 8.1 with a mean of 7.7 and a median of 7.8.

o Acidity (mg/l)

For the reporting period acidity ranged from a minimum of 1.6 to a maximum of 44.9 with a mean of 10.0 and a median of 8.0. For the period of record (1979-1983) acidity ranged from a minimum of 1.6 to a maximum of 64.0 with a mean of 10.0 and a median of 7.3.

o Alkalinity (mg/l)

For the reporting period alkalinity ranged from a minimum of 51.3 to a maximum of 125 with a mean of 93.3 and a median of 98.4. For the period of record (1979-1983) alkalinity ranged from a minimum of 51.3 to a maximum of 174.0 with a mean of 100.8 and a median of 100.

o Conductivity ( $\mu$ mhos/cm)

For the reporting period conductivity ranged from a minimum of 181.0 to a maximum of 327.0 with a mean of 246.7 and a median of 247.0. For the period of record (1979-1983) conductivity ranged from a minimum of 180.0 to a maximum of 354.0 with a mean of 253.2 and a median of 250.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 2.6 to a maximum of 98.5 with a mean of 11.2 and a median of 7.2. For the period of record (1979-1983) chlorides ranged from a minimum of 2.6 to a maximum of 98.5 with a mean of 9.6 and a median of 7.4.

o Sulfates (mg/l)

For the reporting period sulfates ranged from a minimum of 7.1 to a maximum of 26.0 with a mean of 13.3 and a median of 12.8. For the period of record (1979-1983) sulfates ranged from a minimum of 7.1 to a maximum of 43.0 with a mean of 17.9 and a median of 15.8.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.28 to a maximum of 2.12 with a mean of 1.15 and a median of 1.14. For the period of record (1979-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.23 to a maximum of 2.12 with a mean of 1.1 and a median of 1.14.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.013 to a maximum of 0.67 with a mean of 0.071 and a median of 0.039. For the period of record (1979-1983) total phosphorus ranged from a minimum of 0.01 to a maximum of 0.67 with a mean of 0.06 and a median of 0.037.

o Fecal Coliform

Fecal coliform standards were exceeded 14% of the time during the reporting period.

Hydrologic Unit 05110003 - Green River from Barren River to Rough River

A total of 491 miles of streams draining 1,027 square miles are located in this hydrologic unit. Major urban centers include Morgantown (pop. 2,000) and Greenville (pop. 4,631). Recreation center includes Lake Malone. Two water quality monitoring stations are located in this hydrologic unit: Green River at Aberdeen and Mud River near Lewisburg.

Two miles of this unit, located at the source of the Mud River, have been recommended for Aquatic Life/Warmwater Aquatic Habitat and Primary and Secondary Contact Recreation uses. Stream use designation work indicate that Kentucky Surface Water Standards for aluminum, mercury and iron were violated. However, this study revealed that this two mile reach of stream supports a diverse, viable aquatic fauna. Therefore, this stream reach was determined to support the recommended use designation.

o Dissolved Oxygen (DO) (mg/l)

For the reporting period DO ranged from a minimum of 2.4 to a maximum of 12.2 with a mean range of 6.9 to 9.1 and a median range of 6.7 to 9.0.

o pH

For the reporting period pH ranged from a minimum of 6.8 to a maximum of 8.1 with a mean range of 7.4 to 7.5 and a median range of 7.5 to 7.5. For the period of record (1979-1983) pH ranged from a minimum of 5.2 to a maximum of 8.2 with a mean range of 7.5 to 7.5 and a median range of 7.5 to 7.6.

o      Acidity (mg/l)

For the reporting period acidity ranged from a minimum of 0.3 to a maximum of 87.8 with a mean range of 9.4 to 16.3 and a median range of 8.0 to 10.4. For the period of record (1979-1983) acidity ranged from a minimum of 0.00 to a maximum of 87.8 with a mean range of 9.7 to 13.9 and a median range of 8.0 to 9.6.

o      Alkalinity (mg/l)

For the reporting period alkalinity ranged from a minimum of 33.8 to a maximum of 210.0 with a mean range of 97.5 to 144.3 and a median range of 96.7 to 156.0. For the period of record (1979-1983) alkalinity ranged from a minimum of 33.8 mg/l to a maximum of 210.0 with a mean range of 101.2 to 150.0 and a median range of 101.0 to 156.0.

o      Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 3.2 to a maximum of 51.0 with a mean range of 9.8 to 13.3 and a median range of 8.9 to 9.0. For the period of record (1979-1983) chlorides ranged from a minimum of 2.9 to a maximum of 63.7 with a mean range of 10.7 to 15.8 and a median range of 9.3 to 12.0.

o      Conductivity (µmhos/cm)

For the reporting period conductivity ranged from a minimum of 87.0 to a maximum of 561.0 with a mean range of 249.2 to 369.9 and a median range of 249.0 to 361.0. For the period of record (1979-1983) conductivity ranged from a minimum of 87.0 to a maximum of 561.0 with a mean range of 254.2 to 369.6 and a median range of 251.0 to 375.0.

o      Sulfates (mg/l)

For the reporting period sulfates ranged from a minimum of 5.0 to a maximum of 1470.0 with a mean range of 105.6 to 110.2 and a median range of 15.0 to 20.1. For the period of record (1979-1983) sulfates ranged from a minimum of 5.0 to a maximum of 1470.0 with a mean range of 61.8 to 64.4 and a median range of 16.5 to 21.0.

o      NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.03 to a maximum of 3.04 with a mean range of 1.1 to 1.5 and a median range of 1.23 to 1.56. For the period of record (1979-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.03 to a maximum of 3.15 with a mean range of 1.04 to 1.5 and a median range of 1.13 to 1.49.

o      Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.027 to a maximum of 0.96 with a mean range of 0.085 to 0.166 and a median range of 0.063 to 0.125. For the period of record (1979-1983) total phosphorus ranged from a minimum of 0.025 to a maximum of 0.96 with a mean range of 0.076 to 0.199 and a median range of 0.058 to 0.153.

o Fecal Coliform

Fecal coliform standards were exceeded 22% of the time during the reporting period. The highest percentage of violations occurred at the Mud River station.

Hydrologic Unit 05110004 - Rough River

A total of 453 miles of streams draining 1,081 square miles comprise this hydrologic unit. The major urban center is Beaverdam (pop. 3,185). Recreation centers include Rough River Reservoir. One water quality monitoring station is located in this hydrologic unit: Rough River at Dundee.

o Dissolved Oxygen (DO) (mg/l)

For the reporting period DO ranged from a minimum of 5.1 to a maximum of 12.8 with a mean of 9.1 and a median of 8.8.

o pH

For the reporting period pH ranged from a minimum of 6.7 to a maximum of 7.8 with a mean of 7.3 and a median of 7.2. For the period of record (1979-1983) pH ranged from a minimum of 6.3 to a maximum of 8.4 with a mean of 7.3 and a median of 7.3.

o Acidity (mg/l)

For the reporting period acidity ranged from a minimum of 0.3 to a maximum of 48.8 with a mean of 9.2 and a median of 8.0. For the period of record (1979-1983) acidity ranged from a minimum of 0.0 to a maximum of 53.0 with a mean of 9.9 and a median of 8.0.

o Alkalinity (mg/l)

For the reporting period alkalinity ranged from a minimum of 34.0 to a maximum of 194.0 with a mean of 82.0 and a median of 76.6. For the period of record (1979-1983) alkalinity ranged from a minimum of 24.0 to a maximum of 194.0 with a mean of 78.2 and a median of 79.2.

o Conductivity (µmhos/cm)

For the reporting period conductivity ranged from a minimum of 130 to a maximum of 256 with a mean of 202.3 and a median of 203.0. For the period of record (1979-1983) conductivity ranged from a minimum of 96.0 to a maximum of 268.0 with a mean of 200.2 and a median of 204.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 3.6 to a maximum of 13.6 with a mean of 5.1 and a median of 4.6. For the period of record (1979-1983) chlorides ranged from a minimum of 1.6 to a maximum of 21.0 with a mean of 5.0 and a median of 4.6.

o Sulfates (mg/l)

For the reporting period sulfates ranged from a minimum of 3.54 to a maximum of 858.0 with a mean of 97.1 and a median of 22.0. For the period of record (1979-1983) sulfates ranged from a minimum of 3.5 to a maximum of 858.0 with a mean of 57.1 and a median of 19.0.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.15 to a maximum of 1.7 with a mean of 0.65 and a median of 0.57. For the period of record (1979-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.15 to a maximum of 1.7 with a mean of 0.61 and a median of 0.56.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.015 to a maximum of 0.154 with a mean of 0.066 and a median of 0.050. For the period of record (1979-1983) total phosphorus ranged from a minimum of 0.015 to a maximum of 0.53 with a mean of 0.081 and a median of 0.055.

o Fecal Coliform

Fecal coliform standards were exceeded 21% of the time during the reporting period.

Hydrologic Unit 05110005 - Lower Green River

A total of 362 miles of streams draining 919 square miles comprise this hydrologic unit. The major urban center is Owensboro (pop. 54,450). Two water quality monitoring stations are located in this hydrologic unit: Green River near Beech Grove and Green River at Spotsville.

o pH

For the reporting period pH ranged from a minimum of 7.2 to a maximum of 8.0 with a mean of 7.7 and a median of 7.6. For the period of record (1980-1983) pH ranged from a minimum of 7.2 to a maximum of 8.2 with a mean of 7.7 and a median of 7.7.

o Alkalinity (mg/l)

For the reporting period alkalinity was not measured. For the period of record (1974-1981) alkalinity ranged from a minimum of 45.0 to a maximum of 120.0 with a mean of 79.3 and a median of 80.0.

o Conductivity (µmhos/cm)

For the reporting period conductivity ranged from a minimum of 170.0 to a maximum of 450.0 with a mean range of 281.3 to 307.2 and a median range of 290.0 to 312.0. For the period of record (1974-1983) conductivity ranged from a minimum of 130.0 to a maximum of 577.0 with a mean range of 301.8 to 307.6 and a median range of 300.0 to 300.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 3.3 to a maximum of 14.0 with a mean of 8.1 and a median of 8.3. For the period of record (1974-1983) chlorides ranged from a minimum of 2.9 to a maximum of 14.0 with a mean of 6.9 and a median of 6.4.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.23 to a maximum of 1.5 with a mean of 0.95 and a median of 0.98. For the period of record (1974-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.05 to a maximum of 6.8 with a mean range of 0.82 to 0.97 and a median range of 0.83 to 0.87.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.02 to a maximum of 0.32 with a mean range of 0.077 to 0.11 and a median range of 0.07 to 0.08. For the period of record (1974-1983) total phosphorus ranged from a minimum of 0.01 to a maximum of 1.48 with a mean range of 0.08 to 0.19 and a median range of 0.06 to 0.11.

Hydrologic Unit 05110006 - Pond River

A total of 327 miles of streams draining 799 square miles comprise this hydrologic unit. Major urban centers include the eastern half of Madisonville (pop. 16,979) and Central City (pop. 5,214). Two water quality monitoring stations are located in this hydrologic unit: Pond River at KY 85 bridge and Pond River at KY 189 bridge.

o Dissolved Oxygen (DO) (mg/l)

For the reporting period DO ranged from a minimum of 4.1 to a maximum of 13.2 with a mean range of 7.5 to 8.4 and a median range of 6.3 to 8.4.

o pH

For the reporting period pH ranged from a minimum of 5.1 to a maximum of 8.1 with a mean range of 7.1 to 7.5 and a median range of 7.0 to 7.6. For the period of record (1979-1983) pH ranged from a minimum of 4.0 to a maximum of 8.1 with a mean range of 6.97 to 7.6 and a median range of 7.1 to 7.6.

o Acidity (mg/l)

For the reporting period acidity ranged from a minimum of 1.7 to a maximum of 58.5 with a mean range of 9.57 to 10.3 and a median range of 7.6 to 9.0. For the period of record (1979-1983) acidity ranged from a minimum of 1.7 to a maximum of 58.5 with a mean range of 7.9 to 8.6 and a median range of 6.0 to 6.4.

o Alkalinity (mg/l)

For the reporting period alkalinity ranged from a minimum of 12.0 to a maximum of 132.0 with a mean range of 49.4 to 93.6 and a median range of 46.0 to 100.0. For the period of record (1979-1983) alkalinity ranged from a minimum of 0.0 mg/l to a maximum of 164.2 with a mean range of 46.9 to 91.4 and a median range of 46.0 to 93.8.

o Conductivity (µmhos/cm)

For the reporting period conductivity ranged from a minimum of 149.0 to a maximum of 2160.0 with a mean range of 312.6 to 964.9 and a median range of 311.0 to 729.0. For the period of record (1979-1983) conductivity ranged from a minimum of 143.0 to a maximum of 2160.0 with a mean range of 339.0 to 905.0 and a median range of 309.0 to 812.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 5.8 to a maximum of 49.4 with a mean range of 13.8 to 16.0 and a median range of 12.4 to 12.5. For the period of record (1979-1983) chlorides ranged from a minimum of 2.5 to a maximum of 77.6 with a mean range of 13.3 to 19.3 and a median range of 11.4 to 12.5.

o Sulfates (mg/l)

For the reporting period sulfates ranged from a minimum of 13.0 to a maximum of 2500.0 with a mean range of 114.6 to 563.8 and a median range of 34.0 to 361.0. For the period of record (1979-1983) sulfates ranged from a minimum of 13.0 to a maximum of 2500.0 with a mean range of 84.4 to 491.8 and a median range of 34.8 to 380.0.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.02 to a maximum of 1.89 with a mean range of 0.53 to 0.81 and a median range of 0.51 to 0.74. For the period of record (1979-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.01 to a maximum of 3.6 with a mean range of 0.48 to 0.79 and a median range of 0.47 to 0.67.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.007 to a maximum of 0.65 with a mean range of 0.079 to 0.116 and a median range of 0.060 to 0.78. For the period of record (1979-1983) total phosphorus ranged from a minimum of 0.005 to a maximum of 1.13 with a mean range of 0.08 to 0.09 and a median range of 0.05 to 0.07.

o Fecal Coliform

Fecal coliform standards were exceeded 44% of the time during the reporting period. The highest percentage of violations occurred at the Pond River 85 bridge station.

## o Biological

The 1983 biological collections from the Pond River at 85 bridge station showed improvements in biological integrity from previous years. The biological communities appear to be stressed from water quality factors such as turbidity, pH and metals. Improvements in the macroinvertebrate biological community in 1983 were attributed to the extended low flow conditions. Water quality in this stream system is considered fair.

This site was characterized by moderate growths of filamentous blue-green and green algae. The community, exclusive of diatoms, was largely dominated by planktonic green and euglenoid algae. These taxa are associated with eutrophic conditions and are tolerant to sedimentation. Periphyton chlorophyll *a* values were below average (10.1 mg/m<sup>2</sup>, Range (6.7-16.3)) while AFDW values were above average (8.12 g/m<sup>2</sup>, Range (2.03-16.91)), suggesting much heterotrophic activity (i.e. bacteria, protozoans). Plankton chlorophyll *a* values were typical for the BWMP stations (10.6 ug/l). A total of 129 algal species were identified from natural substrates. The diatom community was dominated by epipellic, halophilic, and eutrophic species. It appears that the benthic algal community is being limited by turbidity and other water quality factors such as pH, metals, etc. No change has been observed here since sampling began in 1979.

The invertebrate collections from the Pond River at 85 bridge station are not exceptional for the available habitats. Most of the community is tolerant of many environmental conditions, including siltation and acid mine drainage. Because of the abundance of habitats for invertebrates it is obvious that certain water quality factors such as metals, turbidity, etc. are influencing the benthic community.

No F.D.A. action levels were exceeded in fish tissue at this station in 1983.



## TRADEWATER RIVER BASIN

The Tradewater River basin is located in the western portion of the state within the Shawnee Hills Section of the Interior Low Plateaus Province. This area also contains the western Kentucky coalfield. The Tradewater River originates in northwestern Christian County and flows northwesterly for 132 miles to enter the Ohio River at mile 873.4, near Caseyville, Kentucky. Some of the principal tributaries to the river are Caney Creek, Buffalo Creek, Piney Creek, Flynn Fork, Donaldson Creek, Clear Creek, Craborchard Creek (=Vaughn Ditch) and Cypress Creek (=Smith Ditch). There are 515 miles of streams in the basin depicted on the USGS hydrologic unit map. Lake Beshear is the major impoundment of this area. The Tradewater River drains an area of 943 square miles.

The main stem of the Tradewater originates near the Dripping Springs Escarpment and flows primarily through the deep alluvial and Pennsylvanian deposits of the interior lowlands. The eastern tributaries, which also lie in Pennsylvanian stratas, comprise some of the largest wetlands in the state. In contrast, smaller western tributaries are more upland in nature and flow through Mississippian deposits.

The basin is roughly elliptical in shape and averages approximately 32 miles in width. Elevations range from 320 feet above mean sea level (m.s.l.) at the mouth of the Tradewater River to 806 feet above m.s.l. just north of Hopkinsville, Kentucky. The main stem has an average slope of 0.6 feet/mile from its mouth to mile 73 at Olney. From Olney to its source the average slope is 5.4 feet/mile. In areas where the gradient is slight, wide floodplains and swampy conditions are common.

### Impacts

Portions of the Tradewater River system have been heavily impacted by acid and silt from coal mining in the watershed. Many streams consistently exhibit pH in the range of 3-4 and are heavily silted. Agricultural runoff and domestic sewage discharges from small municipalities are secondary impacts.

The aquatic biota of the eastern tributaries and the mainstem of the Tradewater below Dawson Springs has been severely degraded by acid mine drainage and siltation. The western tributaries are presently serving as a refugia for the aquatic biota of the basin. Although no fish kills were officially reported during the 1982-1983 period, residents in the area indicated that localized fish kills frequently occur. One ambient monitoring station is located in the drainage basin.

### Problem Parameters

Fecal coliform bacteria violations were frequent at the Tradewater monitoring station. Copper and iron levels were elevated in water samples and chlordane in sediment samples.

### Flow

The annual average discharge for the period of record (43 years) is 334 cfs for the Tradewater River at mile point 72.65. Mean discharge for water year 1982 was below the average annual discharge (-22%). However, during water year 1983, mean discharge was 37% above annual average.

### Hydrologic Unit 05140205 - Tradewater River

A total of 515 miles of streams draining 943 square miles comprise this hydrologic unit. Major urban centers include Madisonville (pop. 16,979), Dawson Springs (pop. 3,275), Providence (pop. 4,434), and Sturgis (pop. 2,293). The major recreation centers include Lake Beshear and Pennyriple State Resort Park. One water quality monitoring station is located in the basin on the Tradewater River at Olney.

Approximately 77 stream miles have been recommended for stream use designations. Fourteen miles of the Tradewater River around Dawson Springs plus 11 miles of Montgomery Creek have been recommended for Aquatic Life/Warmwater Aquatic Habitat and Primary and Secondary Contact Recreation use. The fourteen mile segment of the Tradewater River has historically not supported designated uses due to severe acid mine pollution from upstream, eastern tributaries, while Montgomery Creek (11 miles) supports the recommended stream uses. Stream use designation studies revealed violations of Kentucky Surface Water Standards for mercury and aluminum. Also, historical data from this stream reach indicate the pH standards are frequently violated. Sulfates are also elevated in this stream segment.

The Vaughn Ditch/Craborchard Creek stream system encompasses approximately 52 stream miles which has been recommended for designation as Aquatic Life/Warmwater Aquatic Habitat and Primary and Secondary Contact Recreation use. Violations of Kentucky Surface Water Standards for aluminum, mercury, iron, un-ionized ammonia and phthalate esters were observed during stream use designation studies. A major portion of the drainage has been channelized, reducing or eliminating valuable aquatic habitat. Large scale coal mining and agriculture operations have also impaired the water quality and damaged aquatic habitats. Therefore, this stream system partially supports the recommended designated uses.

Owens Creek, a small tributary (4.5 miles) to the Tradewater River near Providence, Kentucky has been recommended for Aquatic Life/Warmwater Aquatic Habitat and Primary and Secondary Contact Recreation uses. This stream does not appear on the Kentucky hydrologic map and is, therefore, not considered in the total stream miles for the Tradewater basin. Violations of Kentucky Surface Water Standards for iron, mercury, phthalate esters, un-ionized ammonia and aluminum were documented during a stream use designation survey. Historical problems with low pH are known to occur in the drainage as a result of acid coal mine drainage. The stream has been channelized for most of its length impairing or eliminating valuable aquatic habitat. The lower 2.5 miles of Owens Creek partially supports the recommended designated uses, while the upper 2 miles does not support the recommended designated uses.

#### o pH

For the reporting period pH ranged from a minimum of 6.6 to a maximum of 7.8 with a mean of 7.2 and a median of 7.1.

#### o Conductivity ( $\mu$ mhos/cm)

For the reporting period conductivity ranged from a minimum of 198.0 to a maximum of 447.0 with a mean of 318.0 and a median of 315.0.

- o Chlorides (mg/l)

For the reporting chlorides ranged from a minimum of 2.3 to a maximum of 6.8 with a mean of 4.55 and a median of 4.8.

- o Total phosphorus

For the reporting period total phosphorus ranged from a minimum of .020 to a maximum of .220 with a mean of .068 and a median of .050.

## LOWER CUMBERLAND RIVER BASIN

The lower Cumberland River basin lies in the Highland Rim Section of the Interior Low Plateaus Province in southwestern Kentucky. The low to moderate gradient streams in the Kentucky portion of the basin drain Mississippian limestones. The river in Kentucky flows northwesterly for 75 miles from the Tennessee border to the Ohio River (mile 920.4) near Smithland, Kentucky. Barkley Dam, near Lake City, Kentucky, impounds 118 miles of the river, 44 miles of which are in Kentucky. There are two major subbasins in this region, the Little River with 601 square miles and the Red River with a total drainage area of 1,460 square miles, of which 688 are in Kentucky. The lower Cumberland River drains 2,084 square miles in Kentucky and receives drainage from another 15,830 square miles of the Cumberland River in Tennessee and southeastern Kentucky. There are 704 miles of streams in the Kentucky portion of the basin depicted on the USGS hydrologic unit map.

The basin lies in two subsections of the Highland Rim, the Pennyroyal Plain and the Western Highland Rim. The Pennyroyal area is a well known karst region consisting of rough and hilly topography, with sinkholes, subsurface drainage, and limestone caverns. The Western Highland Rim subsection consists of a dissected upland plateau with some karst topography, but sinkhole plains are absent. Generally, this subsection is a ridge and valley area characterized by long, somewhat steep, slopes.

Elevations in the basin range from 302 feet above mean sea level (m.s.l.) at the confluence of the Cumberland and Ohio rivers to 863 feet at Pine Knob in Christian County. Slope of the main stem of the Cumberland River below Barkley Lake is 5.7 feet/mile to the point where Livingston Creek enters. The slope from Livingston Creek to the Ohio River is 2 feet/mile or less.

### Impacts

Principal impacts to water quality of the basin include municipal wastewater effluent disposal and nonpoint source agricultural runoff. Mining impacts within the basin are limited to runoff from abandoned fluorspar mines and limestone quarries. Impacts from limestone quarries generally involve slight downstream increases in siltation and alkalinity. Industrial discharges have impacted the drainage, particularly in the Hopkinsville area.

The Kentucky portion of the Cumberland River supports a diverse aquatic biota typical of large rivers. No fish kills were reported in the drainage in 1982 or 1983.

Physiochemical data for the lower Cumberland are provided by the USGS gaging station located near Grand Rivers, Kentucky. Data are reported from October 1980 through September 1981.

### Problem Parameters

Levels of nitrite-nitrite nitrogen were elevated at the sampling station in this basin.

### Flow

The annual average discharge for the period of record (18 years) is 38,630 cfs for the lower Cumberland River at mile point 30.6. Mean discharge for water year 1982 was below the annual average discharge (-15%). However, during water year 1983, mean discharge was 9% above the annual average. The concentration effect of flow reduction during the reporting period was contributing factor to observed increases in certain physicochemical parameters.

#### Hydrologic Unit 05130205 - Lower Cumberland River

A total of 443 miles of streams draining 969 square miles comprise this hydrologic unit. Major urban centers include Hopkinsville (pop. 27,318), Princeton (pop. 7,073), and Cadiz (pop. 1,661). Recreation centers include Lake Barkley. One water quality monitoring station is located in this hydrologic unit: Cumberland River near Grand Rivers.

o pH

For the reporting period pH ranged from a minimum of 7.5 to a maximum of 8.1 with a mean of 7.8 and a median of 7.9. For the period of record (1980-1983) pH ranged from a minimum of 6.7 to a maximum of 8.3 with a mean of 7.8 and a median of 7.9.

o Alkalinity (mg/l)

For the reporting period alkalinity was not measured. For the period of record (1967-1980) alkalinity ranged from a minimum of 47.0 to a maximum of 96.0 with a mean of 67.9 and a median of 67.0.

o Conductivity ( $\mu$ mhos/cm)

For the reporting period conductivity ranged from a minimum of 192.0 to a maximum of 266.0 with a mean of 210.0 and a median of 200.0. For the period of record (1966-1983) conductivity ranged from a minimum of 138.0 to a maximum of 370.0 with a mean of 196.9 and a median of 195.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 2.9 to a maximum of 6.4 with a mean of 4.3 and a median of 4.3. For the period of record (1966-1983) chlorides ranged from a minimum of 1.7 to a maximum of 13.0 with a mean of 4.7 and a median of 4.3.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N was not measured. For the period of record (1972-1981) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.01 to a maximum of 1.2 with a mean of 0.36 and a median of 0.31.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.03 to a maximum of 0.2 with a mean of 0.09 and a median of 0.085. For the period of record (1972-1983) total phosphorus ranged from a minimum of 0.03 to a maximum of 0.62 with a mean of 0.10 and a median of 0.09.

#### Hydrologic Unit 05130206 - Red River

A total of 260 miles of streams draining 687 square miles in Kentucky comprise this subbasin. Major urban centers include Elkton (pop. 1,815) and Adairville (pop. 1,105). There are no water quality monitoring stations located in this hydrologic unit.

## TENNESSEE RIVER BASIN

The Tennessee River basin drains the eastern half of the Jackson Purchase region in the far western corner of the state. Of its total drainage area, 40,330 square miles, only 1,000 square miles are in Kentucky. Most of the 62 miles of the Tennessee River (mainstem) that lie in Kentucky are impounded within Kentucky Lake. There are 369 miles of streams in the Kentucky portion of the basin depicted on the USGS hydrologic unit map. The principal tributary in Kentucky is Clarks River, which has a total drainage area of 530 square miles.

The basin lies in the Eastern Gulf Coastal Plain area of the Coastal Plain Province. Underlying bedrock is composed of a variety of shales, clays and sandstones of Tertiary and Cretaceous age. Basin topography is characterized by strongly rolling to nearly flat terrain; the uplands are variable and often wooded, while valleys are generally wide with extensive cultivation; slopes are steep in some areas along Kentucky lake.

Elevations in the basin vary from 325 feet above mean sea level (m.s.l.) south of Paducah to 640 feet above m.s.l. in southwestern Calloway County. The East Fork of Clarks River has an average slope of 4.6 feet/mile and the West Fork averages 7.0 feet/mile. The mainstem of the Tennessee River to Kentucky Lake Dam is influenced by the Lock and Dam 52 on the Ohio River with a pool elevation of 302 feet above m.s.l.

### Impacts

Impacts to water quality within the Tennessee River basin include nutrient loading from domestic effluents, urban runoff and agricultural activities. Increased silt loads from cultivation of marginally hilly land immediately west of Kentucky Lake represents a threat to the aquatic life of streams in this area.

Industrial impacts are of special concern on the Tennessee River below Kentucky Lake where a large chemical manufacturing complex has developed. Industrial impacts have also influenced water quality in the Paducah area of the lower Tennessee and in the East Fork of Clarks River below Benton and Murray. High levels of heavy metals have been found in sediments of the East Fork Clarks River and pose a threat to the aquatic ecosystem. Physicochemical data for the lower portion of the Tennessee River is provided by the USGS station near Paducah. One fish kill was reported in 1983 and none during 1982. Two ambient monitoring stations are located in the basin on the Tennessee River near Paducah and Clarks River at Almo.

### Flow

The annual average discharge for the period of record (18 years) is 65,450 cfs for the Tennessee River at mile point 21.6. Mean discharge for water year 1982 was below the annual average discharge (-10%). However, during water year 1983, adjusted mean discharge was 16% above the annual average. The concentration effect of flow reduction during the reporting period was a contributing factor to observed increases in certain physicochemical parameters.

### Hydrologic Unit 06040005 - Kentucky Lake Tributaries

A total of 41 miles of streams draining 240 square miles comprise this hydrologic unit. Recreation centers include Kentucky Lake. No water quality monitoring stations are located in this hydrologic unit.

### Hydrologic Unit 06040006 - Tennessee River/Clarks River

A total of 328 miles of streams draining 890 square miles comprise this hydrologic unit. Major urban centers include Paducah (pop. 29,315), Murray (pop. 14,248), and Benton (pop. 370). Recreation centers include Lower Tennessee River. Two water quality monitoring stations are located in this hydrologic unit: Tennessee River near Paducah and Clarks River at Almo.

o pH

For the reporting period pH ranged from a minimum of 6.6 to a maximum of 7.4 with a mean of 7.0 and a median of 7.1. For the period of record (1982-1983) pH ranged from a minimum of 6.6 to a maximum of 7.4 with a mean of 7.0 and a median of 7.0.

o Conductivity ( $\mu$ mhos/cm)

For the reporting period conductivity ranged from a minimum of 80.0 to a maximum of 310.0 with a mean range of 153.9 to 185.7 and a median range of 151.0 to 183.0. For the period of record (1976-1983) conductivity ranged from a minimum of 80.0 to a maximum of 310.0 with a mean range of 172.6 to 178.0 and a median range of 168.0 to 170.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 4.4 to a maximum of 25.0 with a mean of 13.0 and a median of 14.0. For the period of record (1982-1983) chlorides ranged from a minimum of 4.4 to a maximum of 25.0 with a mean of 13.3 and a median of 14.0.

o NO<sub>2</sub>-NO<sub>3</sub>-N (mg/l)

For the reporting period NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.06 to a maximum of 0.72 with a mean of 0.37 and a median of 0.38. For the period of record (1976-1983) NO<sub>2</sub>-NO<sub>3</sub>-N ranged from a minimum of 0.04 to a maximum of 1.19 with a mean of 0.34 and a median of 0.33.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.05 to a maximum of 1.3 with a mean range of 0.102 to 0.549 and a median range of 0.07 to 0.43. For the period of record (1976-1983) total phosphorus ranged from a minimum of 0.05 to a maximum of 1.41 with a mean range of 0.175 to 0.545 and a median range of 0.10 to 0.430.

## MISSISSIPPI RIVER BASIN

The Mississippi River reaches its confluence with the Ohio River at Mississippi river mile 953.8 near Wickliffe, Kentucky and flows southward some 70 miles, forming the state boundary between Kentucky and Missouri. The basin drains a northern extension of the Mississippian Embayment within the far southwestern corner of the state, a physiographic province known as the Coastal Plain. The basin drains approximately 1,200 square miles of the state. Geology of the region is somewhat youthful, being composed of Tertiary age sands, gravels, and clays deposited during a recent subsidence of the Mississippi Embayment. Windblown deposits of loess blanket these Tertiary deposits and are especially well developed as bluffs just east of the river. Principal tributaries to the Mississippi include Mayfield Creek, Obion Creek, and Bayou de Chien. There are 372 miles of streams in the Kentucky portion of the basin depicted on the USGS hydrologic unit map. The Ohio River, the major tributary to the Mississippi River in this region, is discussed in another section.

Topography of the basin varies from strongly rolling to nearly flat terrain. Highest elevations occur along a northwest-southeast ridge which runs from western Calloway County to Ballard County and forms the divide between the Ohio, Mississippi, and Tennessee rivers. Uplands within the basin are smooth to rough with greatest variations in elevation occurring near streams. Extensive floodplain bottoms have developed along the principal tributaries and the Mississippi itself.

### Impacts

Intensive cultivation of the basin area has led to serious sediment loadings to streams. Additional impacts to streams within the basin include agricultural nutrient runoff, domestic effluent discharges, logging, channelization, and, to a lesser extent, industrial waste influences. The tributary streams' aquatic biota has been impacted by siltation. One fish kill was reported from this basin in 1983, none in 1982. There is one ambient monitoring station in the basin.

### Problem Parameters

Copper and iron were problem water problems, while iron and chlordane were problem sediment parameters.

#### Hydrologic Unit 08010201 - Bayou De Chien

A total of 382 miles of streams draining 966 square miles comprise this hydrologic unit. Major urban centers include Mayfield (pop. 10,705), Bardwell (pop. 988), and Clinton (pop. 1,720). Recreation centers include Murphy's Pond. One water quality monitoring station is located in this hydrologic unit: Bayou De Chien near Clinton.

#### o pH

For the reporting period pH ranged from a minimum of 6.6 to a maximum of 7.6 with a mean of 7.2 and a median of 7.2. For the period of record (1982-1983) pH ranged from a minimum of 6.6 to a maximum of 7.8 with a mean of 7.2 and a median of 7.1.

#### o Alkalinity (mg/l)

For the reporting period alkalinity was not measured. For the period of record (1970-1980) alkalinity ranged from a minimum of 32.0 to a maximum of 77.0 with a mean of 43.4 and a median of 41.0.



o Conductivity (μmhos/cm)

For the reporting period conductivity ranged from a minimum of 68.0 to a maximum of 129.0 with a mean of 90.0 and a median of 86.0. For the period of record (1970-1983) conductivity ranged from a minimum of 60.0 to a maximum of 220.0 with a mean of 109.2 and a median of 100.0.

o Chlorides (mg/l)

For the reporting period chlorides ranged from a minimum of 2.8 to a maximum of 7.0 with a mean of 4.7 and a median of 3.7. For the period of record (1970-1983) chlorides ranged from a minimum of 2.5 to a maximum of 7.0 with a mean of 4.2 and a median of 3.7.

o Total Phosphorus (mg/l)

For the reporting period total phosphorus ranged from a minimum of 0.03 to a maximum of 0.18 with a mean of 0.09 and a median of 0.07. For the period of record (1982-1983) total phosphorus ranged from a minimum of 0.03 to a maximum of 0.18 with a mean of 0.09 and a median of 0.07.

### OHIO RIVER MAIN STEM

The Ohio River forms the northern border of the Commonwealth of Kentucky for 664 miles. The river receives impacts from all the major drainages as well as numerous minor basins within the state. In addition, the Ohio receives drainage from large portions of Pennsylvania, Ohio, West Virginia, Indiana and Illinois.

The Division of Water maintains no water quality monitoring stations on the main stem of the Ohio River. Monitoring of the Ohio main stem and lower reaches of major tributaries is the responsibility of the Ohio River Valley Water Sanitation Commission (ORSANCO), a compact of eight states in the Ohio River drainage basin. Information on water quality of the Ohio River main stem is contained in ORSANCO's Water Quality Report to Congress for the same reporting period.

### OHIO RIVER MINOR TRIBUTARIES

There are 3,184 stream miles located in minor basins on the USGS hydrologic unit map within the state along the Ohio River. Drainage impacts occurring in these streams are largely unknown. There are no water quality monitoring stations on any of these Ohio River minor tributaries.

#### Hydrologic Unit 05090201 - Ohio River Minor Tributaries

A total of 329 miles of streams draining 568 square miles comprise this hydrologic unit. Major urban centers include Vanceburg (pop. 1,939), Maysville (pop. 7,983), Brooksville (pop. 680), and Alexandria (pop. 4,735). No water quality monitoring stations are located in this hydrologic unit.

#### Hydrologic Unit 05090203 - Ohio River Minor Tributaries

A total of 144 miles of streams draining 244 square miles comprise this hydrologic unit. Major urban centers include Burlington and Warsaw (pop. 1,328). No water quality monitoring stations are located in this hydrologic unit.

#### Hydrologic Unit 05140101 - Ohio River Minor Tributaries

A total of 258 miles of streams draining 437 square miles comprise this hydrologic unit. Major urban centers include Bedford (pop. 835), LaGrange (pop. 2,971), and northern Jefferson County. No water quality monitoring stations are located in this hydrologic unit.

#### Hydrologic Unit 05140104 - Ohio River Minor Tributaries

A total of 159 miles of streams draining 539 square miles comprise this hydrologic unit. Major urban centers include Vine Grove (pop. 3,583) and Hardinsburg (pop. 2,211). Recreation centers include Otter Creek Park. No water quality monitoring stations are located in this hydrologic unit.

#### Hydrologic Unit 05140201 - Ohio River Minor Tributaries

A total of 117 miles of streams draining 273 square miles comprise this hydrologic unit. Major urban centers include Cloverport (pop. 1,585) and Hawesville (pop. 1,036). No water quality monitoring stations are located in this hydrologic unit.

#### Hydrologic Unit 05140202 - Ohio River Minor Tributaries

A total of 140 miles of streams draining 999 square miles comprise this hydrologic unit. Major urban centers include Henderson (pop. 24,834) and Morganfield (pop. 3,781). No water quality monitoring stations are located in this hydrologic unit.

#### Hydrologic Unit 05140203 - Ohio River Minor Tributaries

A total of 166 miles of streams draining 403 square miles comprise this hydrologic unit. The major urban center is Marion (pop. 3,392). No water quality monitoring stations are located in this hydrologic unit.

#### Hydrologic Unit 05140206 - Ohio River Minor Tributaries

A total of 136 miles of streams draining 181 square miles comprise this hydrologic unit. Major urban centers include the western half of Paducah, LaCenter (pop. 1,044) and Kevil (pop. 382). No water quality monitoring stations are located in this hydrologic unit.

## **APPENDIX C**

### **LOCATION OF TROPICALLY CLASSIFIED LAKES**

## APPENDIX C

### Location of Trophically Classified Lakes

River Basin	Lake	Hydrologic Unit	County
Mississippi Tennessee	Flat Kentucky	08010100 06040003	Ballard Calloway, Marshall, Lyon, Trigg
Lower Ohio	Turner George Mauzy Scenic Carpenter Kingfisher	05140206 05140203 05140202 05140202 05140201 05140201	Ballard Crittenden Union Henderson Daviess Daviess
Lower Cumberland	Barkley Energy Hematite Honker Morris Blythe	05130205 05130205 05130205 04130205 05130205 05130205	Lyon, Trigg Trigg* Trigg* Trigg* Christian Christian
Tradewater	Pennyrile Beshear Loch Mary Peewee Providence City Moffitt	05140205 05140205 05140205 05140205 05140205 05140205	Christian Caldwell, Christian Hopkins Hopkins Webster Union
Green	Campbellsville Freeman Green River Liberty Metcalf County Nolin  Salem Shanty Hollow Spurlington Barren River Mill Creek Briggs Lewisburg Luzerne Malone  Spa Caneyville Rough River	05110001 05110001 05110001 05110001 05110001 05110001  05110001 05110001 05110001 05110002 05110002 05110003 05110003 05110003 05110003  05110003 05110004 05110004	Taylor Hardin Taylor, Adair Casey Metcalf Edmonson, Grayson, Hart Larue Warren Taylor Allen, Barren Monroe Logan Logan Muhlenberg Muhlenberg, Todd, Logan Logan Grayson Breckinridge, Grayson

**APPENDIX C continued**

<b>River Basin</b>	<b>Lake</b>	<b>Hydrologic Unit</b>	<b>County</b>
	Washburn	05110004	Ohio
	Grapevine	05110006	Hopkins
Salt	Guist Creek	05140102	Shelby
	Long Run	05140102	Jefferson, Shelby
	McNeely	05140102	Jefferson
	Shelby	05140102	Shelby
	Beaver	05140103	Anderson
	Marion County	05140103	Marion
	Sympson	05140103	Nelson
	Willisburg	05140103	Washington
Middle Ohio	Jericho	05140101	Henry
	Reformatory	05140101	Oldham
Upper Cumberland	Cannon Creek	05130101	Bell
	Chenoa	05130101	Bell
	Corbin	05130101	Laurel
	Cranks Creek	05130101	Harlan
	Laurel Creek	05130101	McCreary
	Laurel River	05130101	Laurel
	Martins Fork	05130101	Harlan
	Linville	05130102	Rockcastle
	Tyner	05130102	Jackson
	Wood Creek	05130102	Laurel
	Cumberland	05130103	Clinton, Pulaski, Russell, Wayne
	Dale Hollow	05130105	Clinton, Cumberland
Kentucky	Carr Fork	05100201	Knott
	Fishpond	05100201	Letcher
	Pan Bowl	05100201	Jackson
	Buckhorn	05100202	Perry, Leslie
	Bert Combs	05100203	Clay
	Campton	05100204	Wolfe
	Mill Creek	05100204	Powell
	Boltz	05100205	Grant
	Bullock Pen	05100205	Grant
	Corinth	05100205	Grant
	Elmer Davis	05100205	Owen

**APPENDIX C continued**

<b>River Basin</b>	<b>Lake</b>	<b>Hydrologic Unit</b>	<b>County</b>
	General Butler Herrington	05100205 05100205	Carroll Boyle, Garrard, Mercer
	Stanford Wilgreen	05100205 05100205	Lincoln Madison
Licking	A.J. Jolly Cave Run	05100101 05100101	Campbell Bath, Menifee, Morgan, Rowan, Grant
	Doe Run	05100101	Kenton
	Greenbriar	05100101	Montgomery
	Kincaid	05100101	Pendleton
	Sand Lick Creek	05100101	Fleming
	Williamstown	05100101	Grant
	Carnico	05100102	Nicholas
Big Sandy	Fishtrap Dewey	05070202 05070203	Pike Floyd
Little Sandy	Grayson	05090104	Carter, Elliott
	Greenbo	05090104	Greenup
Tygarts Creek	Smokey Valley	05090103	Carter

\*Located in Land Between the Lakes area

## **APPENDIX D**

### **FISH KILL SUMMARY**



**APPENDIX D**  
**Fish Kill Summary**

<b>County</b>	<b>Stream</b>	<b>Date</b>	<b>Miles Affected</b>	<b>Cause</b>	<b>Number of Fish Killed</b>
<u><b>1982</b></u>					
Bullitt	Whittaker Run	Jul 27	0.75	Dairy Manure	500
Clinton	Pickens Br - Illwill Ck Dale Hollow Lake	Mar 28	4 miles and 40-100 acres (lake)	Crude oil	700
Cumberland	Williams Creek	May 12	0.75	Crude oil	-
Daviess	Big Ditch - Panther Ck	Jul 13	9.1	Anhydrous ammonia	7,900
Estill	Crooked Creek	Aug 5	0.1	Herbicides	200
Fayette	Gainsway Farm Pond	May	3 acres	Copper Sulfate	-
Fayette/Scott	North Fork Elkhorn Ck	Jun 6	15 (approx)	Zinc/cyanide	69,306
Fayette	South Fork Elkhorn Ck	Jul 6	-	WWTP malfunction	200
Fayette	West Hickman Ck	Aug 3	1.0	Municipal wastewater	570
Harrison	Indian Creek	Oct 15	-	Manure	4
Henry	Bartlett Branch	Nov 30	-	Unknown Chemicals	-
Jefferson	Beargrass Creek	Jul 29	-	Unknown	250
Johnson	Tom's Creek	May 20	6.0	Chicken Manure	-
Kenton	Banklick Creek	May 5	-	Chlorine	-

**APPENDIX D continued**

**Fish Kill Summary**

<b>County</b>	<b>Stream</b>	<b>Date</b>	<b>Miles Affected</b>	<b>Cause</b>	<b>Number of Fish Killed</b>
Lawrence	Little Blaine Creek	Jul 22	-	Chicken Manure	-
Leslie	Polls Creek - Cutshin Ck	Jan 6	4.0	Crude oil	-
Mason	Limestone Creek - Ohio R	Jul 30	2 - 3 acres	DO depletion	-
Nelson	Cox's Creek	Jul 3	3.0	Dairy manure	500
Nelson	Pottinger Creek	Sept 12	-	Manure	8,050
Nelson	Tributary to Chaplin R	Nov 10	-	Natural DO depletion	25
Pendleton	Fork Lick Creek	Nov 5	1.0	Hog manure	15
Perry/Breathitt	Rockhouse Fork	Jun 24	3.5	Acid mine water	-
Rowan	North Fork Triplett Creek	Sept 22	1.5	Pavement sealer	7,710
Russell	Lilly Creek	Jun 2	-	Municipal wastewater	200
Russell/Casey	Goose Creek	Aug 9	2.25	Dairy Manure	2,256
Wayne	Little South Fork	Apr 13	-	Crudge oil	50

**APPENDIX D continued**

**Fish Kill Summary**

County	Stream	Date	Miles Affected	Cause	Number of Fish Killed
<u>1983</u>					
Bell	Yellow Creek	Sept 13	-	Municipal wastewater	-
Bourbon	Stoner Creek	Sept 10	-	Natural low DO	100
Bullitt	Farm Pond	Jun 3	-	Organic leachate	-
Clinton	Smith and Springs Creeks	Aug 22	2.1	Hog manure	31,375
Fayette	Lexington Reservoir	Apr 8	1 acre	Diesel fuel	3
Franklin	Twin Creek	Apr 28	0.5	Parking lot sealant	100
Franklin	Elkhorn Creek	Aug 30 - Sept 2	15	Ammonia	-
Grayson	Beaver Dam Creek	Mar 10-14	3.83	Pentachlorophenol	11,896
Hardin	Valley Creek	Jul 19	-	Municipal wastewater	-
Harlan	Poor Fork Cumberland R	Jan 27	-	Trailer court waste	-
Harlan	Clover Fork Creek	Aug 9	-	Petroleum	200
Hickman	Mississippi River	Jun 15	-	Hydrochloric Acid	-
Johnson/Lawrence	Hammond Ck - Levisa Fk	Jul 7	-	Crude oil	-
Larue	North Fork Nolin River	Aug 14	0.6	Municipal wastewater	2,160
Leslie	Wolf - Raccoon - Cutshin Cks	Apr 7-8	8.0	Crude oil	-

**APPENDIX D continued**

**Fish Kill Summary**

<b>County</b>	<b>Stream</b>	<b>Date</b>	<b>Miles Affected</b>	<b>Cause</b>	<b>Number of Fish Killed</b>
Leslie	Polls Creek - Cutshin Cks	Jun 7	3.0	Blackwater	-
Leslie	Cutshin Creek	Jul 8	1.7	Crude oil	-
Leslie	Cutshin Creek	Aug 22	2.0	Dust inhibitor	-
Madison	Otter Creek	Jul 12	-	Municipal wastewater	-
Magoffin	Left Fk - Rockhouse Ck - Phipps Fk	May 25	-	Crude oil/brine	-
Magoffin	Oakley Br - Licking R	Nov 5	-	Diesel Fuel	-
Marshall	Watch Creek	Jan 9	1.2	Hog manure	2,044
Martin	Wolf Creek	Aug 8	-	Coal slurry	-
Mason	Limestone Creek	Aug 22	3 acres	Unknown	6,000
Monroe	White Oak Creek	Jul 24	-	Unknown	-
Nelson	Private Lake	Mar 4	3 acres	Municipal wastewater	-
Nelson	Froman - Cox Creeks	May 11	3.69	Hog manure	9,815
Owen	Owenton City Reservoir	Aug 19	-	Copper sulfate	3,000
Pendleton	South Fork Grassy Creek	May 13	6.5	Fuel oil and rendering plant effluent	-
Pendleton	Unnamed tributary	July 28	0.2	Motor oil	30

**APPENDIX D continued**

**Fish Kill Summary**

<b>County</b>	<b>Stream</b>	<b>Date</b>	<b>Miles Affected</b>	<b>Cause</b>	<b>Number of Fish Killed</b>
Perry	North Fork Kentucky R	Mar 28-31	-	Diesel fuel	-
Pike	Caney Creek	Aug 30	-	Diesel fuel	-
Scott	Little Eagle - Eagle Cks	May 1	-	Herbicide	-
Scott	North Fork Elkhorn Creek	Aug 1	0.5	Municipal wastewater	1,000
Scott	North Fork Elkhorn Creek	Aug 8	-	Natural low DO	500
Taylor	Little Brush Creek	Jul 21	-	Hog manure	-
Washington/Marion	Pleasant Run Creek	Jul 5	2.5	Dairy Manure	7,964

## **APPENDIX E**

### **SIGNIFICANT SEDIMENT YIELD RATE WATERSHEDS**

# Appendix E

TOTAL AREA, PERCENT LAND USE, AND PRIMARY SEDIMENT SOURCE OF P.L. 566 WATERSHEDS IN KENTUCKY WITH SIGNIFICANT SEDIMENT YIELD RATES.

RIVER BASIN	HYDRO-LOGIC UNIT	P.L. 566 WATER-SHED	WATER-SHED AREA (ACRES)	LAND COVER (PERCENT OF TOTAL AREA)					POTENTIAL SEDIMENT SOURCE
				AGRICULTURAL	FOREST	MINING	INCOOP. AREAS	WATER	
SEDIMENT DELIVERY CLASS: VERY HIGH									
GREEN	05110002	130	7,700	93.1%	6.1%	0.0%	0.0%	0.6%	AGRIC
		240	9,200	99.7	0.3	0.0	0.0	0.0	AGRIC
	05110006	060	8,050	4.5	15.4	80.1	0.0	0.0	MINING
SEDIMENT DELIVERY CLASS: HIGH									
OHIO R MIN TRIB	05140201	120	9,250	76.8%	17.4%	5.1%	0.0%	0.6%	AGRIC
		190	8,640	98.4	0.0	0.0	0.0	1.6	AGRIC
KENTUCKY	05100205	160	15,820	75.7	24.2	0.0	0.0	0.1	AGRIC
		200	15,990	90.3	3.6	0.0	6.1	0.0	AGRIC
GREEN	05110001	060	10,970	69.2	30.7	0.0	0.0	0.1	AGRIC
		240	14,380	72.9	27.0	0.0	0.0	0.1	AGRIC
		270	8,850	75.7	23.8	0.0	0.0	0.5	AGRIC
	05110002	UN6 1/	10,860	63.0	16.8	0.0	0.0	0.2	AGRIC
	05110004	030	33,260	84.6	14.4	0.0	1.0	0.1	AGRIC
SEDIMENT DELIVERY CLASS: MODERATE									
OHIO R MIN TRIB	05090203	250	7,060	89.5%	10.5%	0.0%	0.0%	0.0%	AGRIC
	UN1 1/		4,490	81.7	12.9	0.0	0.0	5.3	AGRIC
	05140201	140	7,030	94.9	0.7	1.0	0.0	3.4	AGRIC
		170	19,660	74.7	22.0	3.1	0.0	0.2	AGRIC
		210	25,050	74.3	23.9	1.1	0.0	0.7	AGRIC
	05140203	120	11,700	83.2	16.2	0.0	0.0	0.6	AGRIC
BIG SANDY	05070203	130	10,240	27.6	56.7	12.7	0.0	0.0	AGRIC
LICKING	05100101	090	24,620	67.1	32.8	0.1	0.0	0.0	AGRIC
KENTUCKY	05100205	060	23,160	67.5	27.1	0.0	5.4	0.0	AGRIC
		110	27,050	80.2	19.8	0.0	0.0	0.0	AGRIC
GREEN	05110001	230	12,160	94.5	3.5	0.0	11.2	0.0	AGRIC
		250	6,900	84.3	5.5	0.7	0.0	0.4	AGRIC
		300	9,250	55.2	44.5	0.0	0.0	0.3	AGRIC
	05110002	340	37,540	87.1	11.2	0.0	1.5	0.2	AGRIC
	05110003	070	28,970	33.3	20.2	42.0	0.0	4.5	MINING
		090	23,840	39.6	36.7	22.3	0.0	1.5	AGRIC
	05110004	010	27,120	73.3	26.7	0.0	0.0	0.0	AGRIC
		050	19,670	65.1	30.3	0.3	2.3	2.0	AGRIC
		060	30,690	70.0	28.3	0.0	0.0	1.7	AGRIC
		070	24,580	65.9	34.0	0.0	0.0	0.1	AGRIC
	05110005	080	6,620	51.7	45.3	0.0	0.0	0.0	AGRIC
UPPER CUMBERLAND	05130102	030	18,880	62.7	37.3	0.0	0.0	0.0	AGRIC
	05130103	090	4,350	66.2	33.8	0.0	0.0	0.0	AGRIC
	05130105	210	33,180	53.0	42.5	0.5	3.9	0.0	AGRIC
LOWER CUMBERLAND	05130205	270	6,840	69.3	30.7	0.0	0.0	0.0	AGRIC
SALT	05140103	030	12,020	82.1	36.7	0.0	0.0	1.2	AGRIC
SEDIMENT DELIVERY CLASS: LOW									
OHIO R MIN TRIB	05090201	390	26,830	80.2%	17.0%	0.0%	2.7%	0.0%	AGRIC
	05090203	150	4,770	82.3	13.1	0.0	0.0	4.6	AGRIC
		240	13,650	84.7	13.8	0.0	0.0	1.3	AGRIC
	05140104	190	20,480	47.4	47.4	0.0	0.0	5.2	AGRIC
		240	5,540	47.7	46.6	0.0	0.0	5.6	AGRIC
	05140201	060	15,950	56.3	40.4	0.6	0.0	0.6	AGRIC
	05140203	060	18,950	54.9	43.4	0.8	0.0	1.0	AGRIC
		190	14,210	61.2	32.8	0.0	0.0	6.1	AGRIC
TRADEWATER	05140205	020	9,330	13.4	69.3	17.3	0.0	0.0	MINING
TYGARTS CREEK	05090103	200	2,740	28.6	60.2	4.0	0.0	6.9	AGRIC
LICKING	05100101	050	13,850	44.2	55.4	0.2	0.0	0.2	AGRIC
		060	31,140	52.0	47.4	0.6	0.0	0.0	AGRIC
		260	13,610	90.9	8.3	0.0	0.0	0.8	AGRIC
	05100102	030	19,100	87.0	12.7	0.0	0.0	0.3	AGRIC
		070	17,130	85.4	11.4	0.0	0.0	0.2	AGRIC
		080	30,560	72.8	27.1	0.0	0.0	0.1	AGRIC
KENTUCKY	05100201	190	12,030	54.7	64.9	0.4	0.0	0.0	AGRIC
		200	11,630	58.3	58.9	2.8	0.0	0.0	AGRIC
		230	5,130	52.9	67.1	0.0	0.0	0.0	AGRIC
	05100203	060	25,760	61.5	57.1	1.4	0.0	0.0	AGRIC
	05100204	090	5,530	29.5	70.5	0.0	0.0	0.0	AGRIC
		130	14,750	36.8	61.1	0.1	0.0	0.0	AGRIC
		180	31,000	61.0	38.9	0.0	0.0	0.0	AGRIC
	05100205	010	25,370	62.6	37.4	0.0	0.0	0.0	AGRIC
		100	70,900	81.1	16.8	0.0	1.9	0.2	AGRIC
		170	60,010	85.9	11.3	0.0	1.1	1.7	AGRIC
		180	61,870	75.3	24.7	0.0	0.0	0.0	AGRIC
		300	14,090	56.4	43.6	0.0	0.0	0.0	AGRIC
		320	21,410	68.8	10.8	0.0	0.0	0.4	AGRIC
		380	21,230	61.3	11.7	0.0	7.0	0.0	AGRIC
		400	15,470	65.3	4.7	0.0	0.0	0.0	AGRIC
GREEN	05110001	030	50,690	63.7	35.5	0.0	0.0	0.8	AGRIC
		060	6,460	42.1	57.9	0.0	0.0	0.0	AGRIC
		160	33,980	84.0	15.7	0.0	0.0	0.3	AGRIC
		170	33,660	78.6	18.6	0.0	2.4	0.4	AGRIC
	05110002	040	30,770	55.3	44.7	0.0	0.0	0.1	AGRIC
		050	20,040	52.5	46.6	0.0	0.0	0.8	AGRIC
		160	70,870	76.5	23.3	0.0	0.0	0.1	AGRIC
		170	11,760	44.8	8.8	0.0	27.2	0.0	AGRIC
		180	111,090	76.3	23.3	0.0	0.0	0.4	AGRIC

1/ : UN6 IS AN UNNUMBERED WATERSHED DRAINED BY DIFFICULT CREEK  
UN1 IS AN UNNUMBERED WATERSHED DRAINED BY LANDING CREEK

RIVER BASIN	HYDRO- LOGIC UNIT	P.L. 566 WATER- SHED	WATER- SHED AREA (ACRES)	LAND COVER (PERCENT OF TOTAL AREA)					POTEN- TIAL SEDIM- ENT SOURCE	
				AGRICUL- TURAL	FOREST	MINING	INCCRP. AREAS	WATER		
SEDIMENT DELIVERY CLASS: LOW (CONTINUED)										
GREEN	05110002	200	51,250	73.4	18.3	0.0	6.1	2.2	AGPTIC	
		230	47,630	91.7	2.0	0.0	6.2	0.0	AGPTIC	
		340	34,420	66.4	33.2	0.1	0.0	0.2	AGPTIC	
	05110004	040	81,590	62.0	29.6	0.0	0.0	8.4	AGPTIC	
		080	16,020	39.5	59.5	0.0	0.0	1.0	AGPTIC	
		090	26,310	47.6	52.1	0.0	0.0	0.0	AGPTIC	
		150	10,570	35.2	64.4	0.3	0.0	0.1	AGPTIC	
		160	46,600	51.0	39.1	7.6	2.2	0.2	AGPTIC	
		170	24,740	41.0	55.5	3.4	0.0	0.1	AGPTIC	
	05110005	040	26,200	57.6	30.4	10.5	0.0	1.5	AGPTIC	
		110	49,130	72.2	26.9	0.6	0.0	0.3	AGPTIC	
		130	6,640	56.6	43.2	0.0	0.0	0.0	AGPTIC	
		140	18,040	73.1	26.6	0.1	0.0	0.1	AGPTIC	
		150	15,530	49.2	46.1	4.2	0.0	0.5	AGPTIC	
		050	18,330	13.9	43.4	26.4	4.4	8.9	MINING	
UPPER CUMBERLND	05110006	050	18,330	13.9	43.4	26.4	4.4	8.9	MINING	
	05130101	180	22,290	45.2	49.3	3.3	2.1	0.1	AGPTIC	
LOWER CUMBERLND	05130205	240	12,040	24.5	66.6	8.8	0.0	0.1	AGPTIC	
		260	19,630	79.6	20.4	0.0	0.0	0.0	AGPTIC	
	SALT	05140102	070	18,370	53.8	41.0	0.0	0.0	0.2	AGPTIC
		06040006	070	6,850	55.3	38.7	0.0	6.0	0.0	AGPTIC
MISSISSIPPI	06010201	020	46,740	64.5	13.2	0.0	0.0	0.3	AGPTIC	